Precision feeding of lactating sows: development of a decision support tool to handle variability

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Nutritional requirements of lactating sows mainly depend on milk yield and greatly vary across individuals. Moreover, because the same diet is generally fed to all sows, and feed intake is low and highly variable, nutrient supplies are often insufficient to meet the requirements, especially those of primiparous sows. Conversely, sows with high appetite may be fed nutrient in excess. Acquiring data on sows and their environment at high-throughput allows the development of new precision feeding systems with the perspective of improving technical performance and reducing feeding cost and environmental impact. The objective of this study was thus to design a decision support tool that could be incorporated in automated feeding equipment. The decision support tool was developed on the basis of InraPorc® model. The optimal supply for a given sow is determined each day according to a factorial approach considering all the information available on the sow (i.e. parity, litter size, milk production, body condition…) or predicted from real-time data (i.e. expected feed intake). The approach was tested using data from 817 lactations. Precision feeding (PF) with the mixing of two diets with different nutritional values was then simulated in comparison with conventional feeding (CF) with a single diet. In sows fed in excess PF reduced average digestible lysine excess from 10.9 to 2.7 g/d, whereas in deficient sows the deficiency was reduced from -5.7 to -2.1 g/d. Overall, PF reduced average lysine intake by 6.8%. At the same time, with PF, lysine requirement was met for a higher proportion of sows, especially in younger sows, and a lower proportion of sows, especially older sows, received excessive supplies. PF also reduced average phosphorus intake while limiting the occurrence of excess and deficiency. This study confirms the potential of precision feeding in order to better achieve nutritional requirements of lactating sows and reduce their nutrient intake and excretion. This project has received funding from the European Union's Horizon 2020 research and innovation program, grant agreement no. 633531.

Identification of biological variables associated with robustness of piglets at weaning

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The robustness of a piglet at weaning can be seen as its ability to express optimal growth without any health problems and regardless of weaning conditions. The identification of the level of the robustness of piglets at weaning could allow implementing targeted cares and treatments. The aim of this study was to identify some biological markers measured around weaning that could be associated with the growth of the piglet after weaning. Blood variables (n=62) describing immunity, stress, oxidative status and metabolism were measured at 26 and 33 days of age on piglets (n=288) from 16 commercial farms selected with contrasting sanitary statuses (deteriorated: SS- or good: SS+). The sanitary status of the farm was significantly associated with 37 of 67 variables measured ($P<0.05$). Thus, piglets reared on SS- farms showed higher activation of the immune system, mobilization of body reserves and oxidative stress after weaning than SS+ piglets. In order to evaluate differences in robustness within farms, the relative ADG from 26 to 47 days of age was calculated (RADG = ADG from 26-47 days of age divided by live weight at 26 days), and piglets were then classified according to the median of their farm in classes of low or high RADG (RADG- or +). This classification was considered as a proxy of robustness. After weaning, RADG+ piglets showed greater immune activation (neutrophil count), lower mobilization of body reserves (non esterified fatty acids and creatinine) and a higher concentration in vitamin A, an antioxidant vitamin, compared to RADG- piglets.